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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. § 1.53(b))

Attorney Docket No. 678-231 (P8635)

First Inventor or Application Identifier Byung-Seok RYU

Title Apparatus For Synthesizing

Express Mail Label No. EL229888061USD

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

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1. ☒ * Fee Transmittal Form (e.g., PTO/SB/17)
(Submit an original and a duplicate for fee processing)
2. ☒ Specification [Total Pages 15]
(preferred arrangement set forth below)
 - Descriptive title of the Invention
 - Cross References to Related Applications
 - Statement Regarding Fed sponsored R & D
 - Reference to Microfiche Appendix
 - Background of the Invention
 - Brief Summary of the Invention
 - Brief Description of the Drawings (if filed)
 - Detailed Description
 - Claim(s)
 - Abstract of the Disclosure
3. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets 4]
4. Oath or Declaration [Total Pages 2]
 - a. ☒ Newly executed (original or copy)
 - b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
(for continuation/divisional with Box 16 completed)
 - i. ☐ **DELETION OF INVENTOR(S)**
Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

5. ☐ Microfiche Computer Program (Appendix)
6. Nucleotide and/or Amino Acid Sequence Submission (if applicable, all necessary)
 - a. ☐ Computer Readable Copy
 - b. ☐ Paper Copy (identical to computer copy)
 - c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

7. ☒ Assignment Papers (cover sheet & document(s))
8. ☐ 37 C.F.R. § 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney
9. ☐ English Translation Document (if applicable)
10. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
11. ☐ Preliminary Amendment
12. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
13. ☐ * Small Entity Statement(s) ☐ Statement filed in prior application
(PTO/SB/09-12) ☐ Status still proper and desired
14. ☐ Certified Copy of Priority Document(s)
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16. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No. _____

Prior application information: Examiner _____

Group / Art Unit: _____

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**APPARATUS FOR SYNTHESIZING SPEECH SOUNDS OF A SHORT
MESSAGE IN A HANDS FREE KIT FOR A MOBILE PHONE**

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to a hands free kit for a car phone or mobile phone used in a car, and more particularly, to an apparatus for generating speech sounds of a short message received by the mobile phone by means of a digital signal processor (DSP).

2. Description of the Related Art

10 A hands free kit for a car phone or portable mobile phone used in a car enables the driver to safely communicate through the mobile phone without holding the phone, e.g., while both hands are on the steering wheel. (As used hereafter, the term "mobile phone" applies to both a dedicated car phone and a portable mobile phone.) The hands free kit employs a half-duplex circuit to transmit/receive audio
15 signals to/from the handset of the mobile phone through transmit and receive lines, respectively. The half-duplex circuit functions to prevent sounds from the speaker from being inputted to the microphone, i.e., to prevent feedback.

20 A conventional hands free kit performs the communication function only when the driver has established the communication path between the handset and the hands free kit by manually operating a key on the handset. In order to eliminate such manual handset operation, the hands free kit has recently been provided with a voice control means to control the functions of the handset and to dial by voice. This feature is made possible by equipping the hands free kit with speech recognition technology embodied by a DSP therein.

Mobile phone handsets have been furnished with short message service (SMS) from communication service providers. The SMS is used to transmit a short message to the mobile phone from a caller or broadcasting service, which is displayed on the mobile phone handset display in characters. When receiving a short message, the handset outputs an audible alarm to alert the user of the reception of a message. If a short message is received while the system is operating in the hands free mode, i.e., with the handset connected to the hands free kit, the handset delivers a signal to the hands free kit indicating the same, whereupon the hands free kit sounds an alarm. The user must then manually operate the handset to read the message on the handset display. Should the user attempt to perform this task while actively driving, however, the user may create a hazardous situation.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide an apparatus for synthesizing speech sounds to express a short message received in a handset coupled to a hands free kit by means of speech recognition and speech synthesis, and a method therefor.

According to one aspect of the invention, an apparatus for synthesizing speech sounds to express a short message received from a caller in a handset coupled to a hands free kit, includes handset circuitry for transferring an alarm signal to the hands free kit to generate an alarm to inform the user of the receipt of the short message. The handset transfers the short message to the hands free kit when receiving a short message calling signal from the hands free kit. The short message calling signal is generated upon the detection of a predetermined voice command by the user indicating a desire to hear the short message. The hands free kit includes circuitry for synthesizing speech sounds corresponding to the short message received from the handset.

According to another aspect of the present invention, a method for synthesizing speech sounds to express a short message in a hands free kit includes: generating an alarm upon receiving an alarm signal from the handset to inform the user of the receipt of a short message; detecting whether speech is input; detecting whether a sound data storage contains the same sound characteristics as the input speech; detecting whether the input speech is a sound synthesis command; and transmitting a short message calling signal to the handset upon detecting the sound synthesis command. The short message is then received from the handset and analyzed to synthesize the sound data corresponding to the short message by reading sound element data from a sound element code storage according to the analyzed result. The sound data is then converted into analog audio signals applied to a speaker.

The present invention will now be described more specifically with reference to the attached drawings only by of example.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a handset connected to a hands free kit;

Fig. 2 is a block diagram of a mobile phone handset;

Fig. 3 is a block diagram of a hands free kit that synthesizes speech sounds according to an embodiment of the present invention; and

Fig. 4 is a flow chart illustrating a method of synthesizing speech sounds to express a short message in accordance with the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, a connection arrangement of a hands free kit 200, a mobile phone handset 100 and a cradle 1 is depicted. Handset 100 is mountable on

cradle 1, with the former having a hands free connector connected to hands free kit 200 through a hands free cable. The cradle 1 also typically contains electronics and a hands free kit connector. A hands free mode may be entered automatically when the handset is mounted on the cradle, or by depressing a specific key (not shown) on the handset or on the hands free kit. In the hands free mode, when a communication channel is established by receiving or transmitting a call through the handset 100, the user's speech is captured by a hands free kit microphone MIC 2 and the incoming audio wirelessly received from the other calling party is output by hands free kit speaker SP2. Hands free kit 200 transfers the audio signals received from the handset through the hands free cable to speaker SP2, or routes the audio signals generated by microphone MIC2 to the handset 100 to wirelessly transmit the same to the other calling party through an antenna ANT. The cradle 1 is also connected to the hands free kit 200 and provides signals to the hands free kit to inform the same of the state of the handset 100 mounted on the cradle 1 or the battery power level thereof. Note that antenna ANT may either be mounted on the handset itself or on the automobile; in the latter case the antenna is connected to the handset via a wire.

Referring to FIG. 2, a block diagram illustrating an exemplary configuration of handset 100 is shown. A first control unit 10 includes a read only memory (ROM) for storing an operational program, a random access memory (RAM) for temporarily storing data generated when executing the operational program, and a read/write memory such as an electronically erasable and programmable read only memory (EEPROM). An input key pad 20 includes a plurality of alphanumeric and functional keys to generate key data transferred to the first control unit 10. Control unit 10 controls a display 30 to display the key data and various information such as the operational state of the handset in icons and characters. A radio frequency (RF) part 40 modulates and demodulates the signals received and transmitted through the

antenna. A signal processor 50 processes the audio or data signals received from the RF part 40 to generate sound through a speaker SP1 or data transferred to the first control unit 10. The signal processor 50 encodes the audio signals received through the microphone MIC1, converting them into the baseband signals transferred to the RF part 40. It also converts the data received from the first control unit 10 into the baseband signals transferred to the RF part 40. The hands free connector 60 is connected through a data line to the first control unit 10, and through an audio line to the signal processor 50.

With handset 100 mounted on the cradle 1 and connected through the hands free connector 60 to the hands free kit 200, the handset 100 and hands free kit 200 are initialized according to a prescribed protocol. Then, control unit 10 controls the signal processor 50 to transfer the audio signals received from the RF part 40 to the hands free kit 200. Control unit 10 also controls the signal processor 50 to transfer the audio signals generated by the microphone MIC2 of the hands free kit 200 to the RF part 40. Generally, the hands free connector 60 of handset 100 includes a data transfer terminal and a battery recharging terminal.

With reference now to FIG. 3, a block diagram of an exemplary configuration of hands free kit 200 is shown. An interface 130, connected to handset 100 via hands free connector(s) 60 and a hands free cable (if any), separates the signals received from handset 100 into data and audio signals. A second control unit 110 includes ROM for storing an operational program, RAM for temporarily storing the data generated when executing the operational program, and an EEPROM for storing telephone numbers inputted by the user. The second control unit 110 may consist of a one-chip microprocessor including a sentence analyzer 112 to analyze the SMS short message received from the handset 100 through the interface 130.

A dictionary storage 114 stores a body of information concerning the alphabet

for the associated language including phonetic information. Storage 114 is preferably included in the EEPROM of control unit 110, but is shown separately for clarity of presentation. The sentence analyzer 112 analyzes the short message into phonetic symbols and sound elements in reference to the dictionary storage 114 so as to generate grammatical information data of the phonetic symbols and the phonetic information data of the sound elements.

A full-duplex module 120 performs simultaneous transmission in both directions under the control of the second control unit 110 to transfer the audio signals from the handset 100 to the speaker SP2, and those from microphone MIC2 through the interface 130 to the handset 100. Module 120 includes an echo canceler (not shown) to eliminate reflective noises. A sound memory 160 includes a sound data storage 162 and a sound element code storage 164. The sound data storage 162 stores speech sound data to dial by voice in a voice dialing mode, as well as addresses in the EEPROM of stored phone numbers corresponding to the stored speech sound data. Data storage 162 also stores speech sound data corresponding to voice commands to control the functions and the addresses of the functional flags, which are stored in a specific memory of the handset 100 to set its functions. The sound code element storage 164 stores the sound element codes to represent respective alphabet letters, sub-words and words, e.g., of the Korean language.

The sound data stored within sound data storage 162 may be obtained during a set-up mode (or training mode) of the system. In particular, during the set-up mode, the user is prompted to speak one or more specific commands. One command, e.g., "read message", is an instruction for the system to proceed with a speech synthesis operation when a short message is received. The short message is then converted to synthesized or "canned" speech and output through the speaker SP2. As will be explained further below, in the hands free operating mode, when handset 100

receives a short message through the wireless communication system, an alarm is generated to inform the user of the same. Then, if the user utters the appropriate "read message" command, and the system properly recognizes the command, the system will convert the short message to audible speech. To improve the probability of successful speech recognition, during the set-up mode, the user utters the "read message" and other commands for conversion into audio feature data by a speech recognition means 140. This audio feature data is stored in sound data storage 162 as feature data to be subsequently compared against during system operation.

Additionally, the training mode is used to collect and store called party name data to be compared against in the voice dialing mode. The voice dialing mode and the short message synthesis mode are preferably concurrent modes. That is, during hands free operation, the user is able to both dial by voice and to listen to synthesized short messages.

During the hands free operating mode, speech recognition means 140 converts analog audio signals from the microphone MIC2 to sound data, which is compared with the sound data stored in sound data storage 162. When a short message is received and an alarm is generated indicating the same, the speech recognition system compares received speech with the stored command for initiating speech synthesis with respect to the message. In the voice dialing mode, the input speech is compared to the stored called party name data. In either case, when a match between input speech and stored sound data is found, speech recognition means 140 informs the second control unit 110 of the address representing the sound data of the stored speech.

The speech synthesis module 150 processes grammatical information data of phonetic symbols and phonetic information data from the sentence analyzer 112, corresponding to the SMS message, to generate sound data for conversion to analog

audio signals. This results in the received SMS message being converted to audible speech which is output by speaker SP2. Module 150 includes a control information generator 152 and a speech synthesizer 154. The control information generator 152 arranges synthetic units of the speech according to the grammatical information data of the phonetic symbols to generate the control information concerning the phonemes, pitches, strengths, lengths, tempos, rhythms, etc. of the speech sounds. The speech synthesizer 154 retrieves the sound element data from the sound element code storage 164 according to the phonetic information data to synthesize the sound data. It converts the sound data to the desired audio signals according to the control information data. The audio signals are transferred through the full-duplexer module 120 to the speaker SP2. The speech recognition means 140 and sound synthesis module 150 are each preferably embodied as part of a DSP.

FIG. 4 is a flowchart illustrating a method of synthesizing speech sounds of a short message in accordance with the invention. The method steps on the left hand side, 401-405, represent steps performed in the first control unit 10 of handset 100, whereas those on the right hand side, 411 to 420, are performed in the second control unit 110 of the hands free unit. The first control unit 10 of handset 100 detects receipt of a short message in step 401. The received short message is displayed on the display 30 and stored in memory in step 402. Then, first control unit 10 informs the hands free kit 200 of the receipt of the short message by transferring an alarm signal through the hands free connector 60 in step 403.

When the alarm signal is transferred through the interface 130 of the hands free kit 200 to the full-duplex module 120 in step 403, the second control unit 110 controls the full-duplex module 120 to generate an alarm through the speaker SP2 in step 411. At this point, the system is striving to detect the previously stored, special speech command of the user, e.g., "read message". Upon proper detection of this

command, the system proceeds to convert the short message to audible speech. Simultaneously, the system is also listening for a called party name, or a previously stored telephone number, to be dialed in the voice dialing mode. If speech corresponding to a stored called party name or telephone number is recognized by means of a favorable comparison of the input speech with previously stored data in sound data storage 162, the system will first convert the corresponding stored data to an audible output to allow the user to verify the same via another voice command, prior to the system automatically dialing the telephone number.

Thus, to implement the above functions, if the second control unit 110 detects speech from microphone MIC2 in step 412, the speech recognition means 140 receives input speech from the full-duplexer module 120 to generate corresponding sound data under the control of the second control unit 110 in step 414. Then, the speech recognition means 140 compares the sound data of the input speech to ascertain whether the sound data storage 162 contains the corresponding sound data having the same (or substantially the same) sound characteristics as the speech in step 414. If so, the speech recognition means 140 retrieves the address representing the sound data to transfer it to the second control unit 110. In step 415, the second control unit 110 determines whether the data stored in the address represents a telephone number or functional command. If the data is a functional command, the second control unit 110 determines whether the functional command indicates a speech synthesis command. If it is the speech synthesis command, the second control unit 110 generates a short message calling signal transmitted through the interface 130 to the handset 100 in step 416.

Meanwhile, the first control unit 10 of the handset 100 detects receipt of the short message calling signal in step 404 after transferring the alarm signal in the previous step 403. Receiving the short message calling signal, the first control unit

10 retrieves the short message from the memory to transfer it through the hands free connector 60 to the hands free kit 200 in step 405. (It is noted here that as an alternative embodiment, the short message can be automatically transferred to the hands free kit as soon as it is received by the handset. In this case, the method steps involving generating and detecting a short message calling signal would be eliminated.)

Subsequently, the second control unit 110 of the hands free kit 200 detects receipt of the short message from the handset 100 in step 417. Receiving the short message, the second control unit 110 analyzes the sentences of the short message in reference to the dictionary of the dictionary storage 114 so as to generate the grammatical information data of the phonetic symbols and the phonetic information data of the sentences to the speech synthesis module 150. The control information generator 152 of the speech synthesis module 150 arranges synthetic units of the speech according to the grammatical information data of the phonetic symbols to generate the control information concerning the phonemes, pitches, strengths, lengths, tempos, rhythms, etc. of the speech sounds. The speech synthesizer 154 of the speech synthesis module 150 retrieves in step 419 the sound element data from the sound element code storage 164 according to the phonetic information data to synthesize the sound data. It also converts the sound data to the desired audio signals according to the control information data. In step 420, the audio signals are transferred through the full-duplexer module 120 to the speaker SP2.

While the present invention has been described with specific embodiments accompanied by the attached drawings, it will be appreciated by those skilled in the art that various changes and modifications may be made thereto without departing the gist of the present invention.

WHAT IS CLAIMED IS:

1. An apparatus for synthesizing speech sounds to express a short message received in a wireless communications system in a handset coupled to a hands free kit, comprising:

5 handset circuitry for transferring an alarm signal to said hands free kit to generate an alarm to inform a user of the receipt of said short message, and for transferring said short message to said hands free kit when receiving a short message calling signal from said hands free kit; and

10 hands free kit circuitry for synthesizing said speech sounds according to said short message received from said handset.

2. The apparatus as defined in Claim 1, wherein said hands free kit circuitry comprises:

a sound element code storage for storing sound element codes representing respective alphabet letters;

15 a dictionary storage for storing a dictionary;

a sentence analyzer for analyzing said short message into phonetic symbols and sound elements in reference to said dictionary so as to generate the grammatical information data of said phonetic symbols and the phonetic information data of said sound elements;

20 a control information generator for generating control information according to said grammatical information data;

a speech synthesizer for synthesizing sound data by reading sound element data from said sound element code storage according to said phonetic information data to convert said sound data into audio signals according to said control information;

25

a full-duplexer module for transferring said audio signals to a speaker to produce sounds; and

a control unit for controlling said sentence analyzer to transmit said short message calling signal to said handset according to an external speech synthesis command upon receiving said alarm signal from said handset.

3. The apparatus as defined in Claim 2, wherein said speech synthesizer and control information generator consist of a digital signal processor (DSP).

4. The apparatus as defined in Claim 2, wherein said full-duplexer module includes an echo canceler for eliminating reflective noises.

5. In a hands free kit coupled to a handset, said hands free kit comprising a sound data storage for storing sound data to control functions and to dial by voice, and a sound element code storage for storing sound element codes representing respective alphabet letters, a method for synthesizing speech sounds to express a short message, comprising the steps of:

generating an alarm upon receiving an alarm signal from said handset to inform the user of the receipt of a short message and detecting whether speech is input;

detecting whether said sound data storage contains sound data having substantially the same sound characteristics as said input speech;

detecting whether said input speech is a sound synthesis command if said sound storage contains sounds having the same sound characteristics as said speech;

transmitting a short message calling signal to said handset upon detecting said sound synthesis command;

detecting said short message received from said handset;

analyzing said short message and synthesizing sound data corresponding to said short message by reading sound element data from said sound element code storage according to the analyzed result; and

5 converting said synthesized sound data into analog audio signals applied to a speaker.

6. The method as defined in Claim 5, wherein said generating an alarm step includes the sub-steps of:

detecting whether said short message is received by said handset;

10 storing said short message in a memory and displaying it on a display of said handset; and

causing said handset to generate said alarm signal transferred to said hands free kit.

7. The method as defined in Claim 5, wherein said transmitting step includes the sub-steps of:

causing said handset to detect whether said short message calling signal is received from said hands free kit; and

transmitting said short message transferred to said hands free kit upon detecting said short message calling signal.

8. An apparatus for synthesizing speech sounds to express a short message received in a wireless communications system in a handset coupled to a hands free kit, comprising:

handset circuitry operative to transfer said short message to said hands free

kit; and

hands free kit circuitry adapted to synthesize said speech sounds according to said short message received from said handset.

9. The apparatus as defined in Claim 8, wherein said handset circuitry is further operative to transfer an alarm signal to said hands free kit upon the receipt of said short message; and

said hands free kit circuitry is further adapted to store a voice command indicating a desire for a user to hear a short message, to generate an alarm upon the receipt of said alarm signal, to receive input speech following said alarm generation and determine whether the input speech contains said voice command, and to synthesize said speech sounds and produce said message as an audible output upon the detection of said voice command.

10. The apparatus as defined in Claim 9, wherein said hands free kit circuitry is further adapted to store a plurality of voice dialing mode data, and to determine, after said alarm generation, whether said input speech corresponds to any of said voice dialing mode data and if so to synthesize sounds of the corresponding voice dialing mode data without synthesizing sounds of said short message.

ABSTRACT OF THE DISCLOSURE

An apparatus for synthesizing speech sounds to express a short message received from a caller in a handset coupled to a hands free kit, includes handset circuitry for transferring an alarm signal to the hands free kit to generate an alarm to inform the user of the receipt of the short message, and for transferring the short message to the hands free kit when receiving a short message calling signal from the hands free kit. The short message calling signal is generated upon the detection of a predetermined voice command by the user indicating a desire to hear the short message. The hands free kit includes circuitry for synthesizing the speech sounds according to the short message received from the handset.

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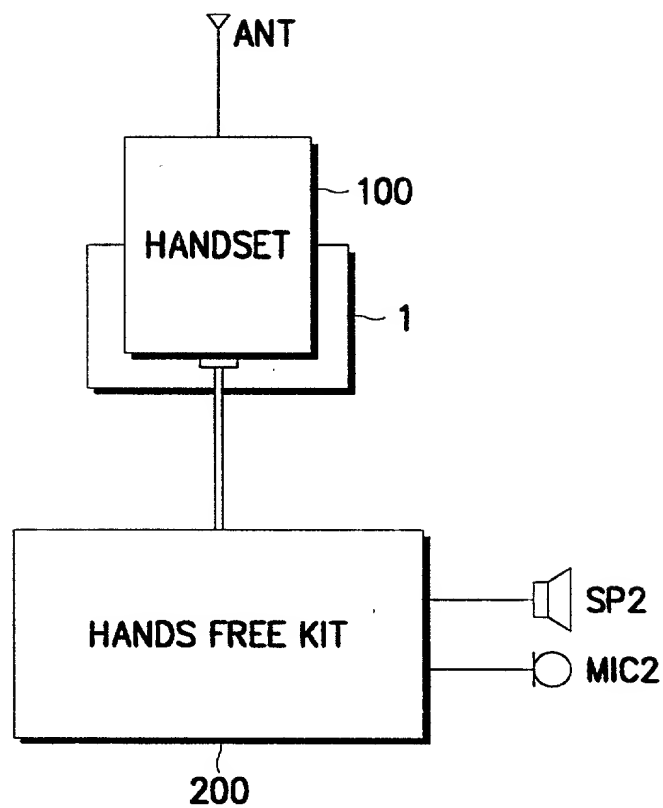


FIG. 1

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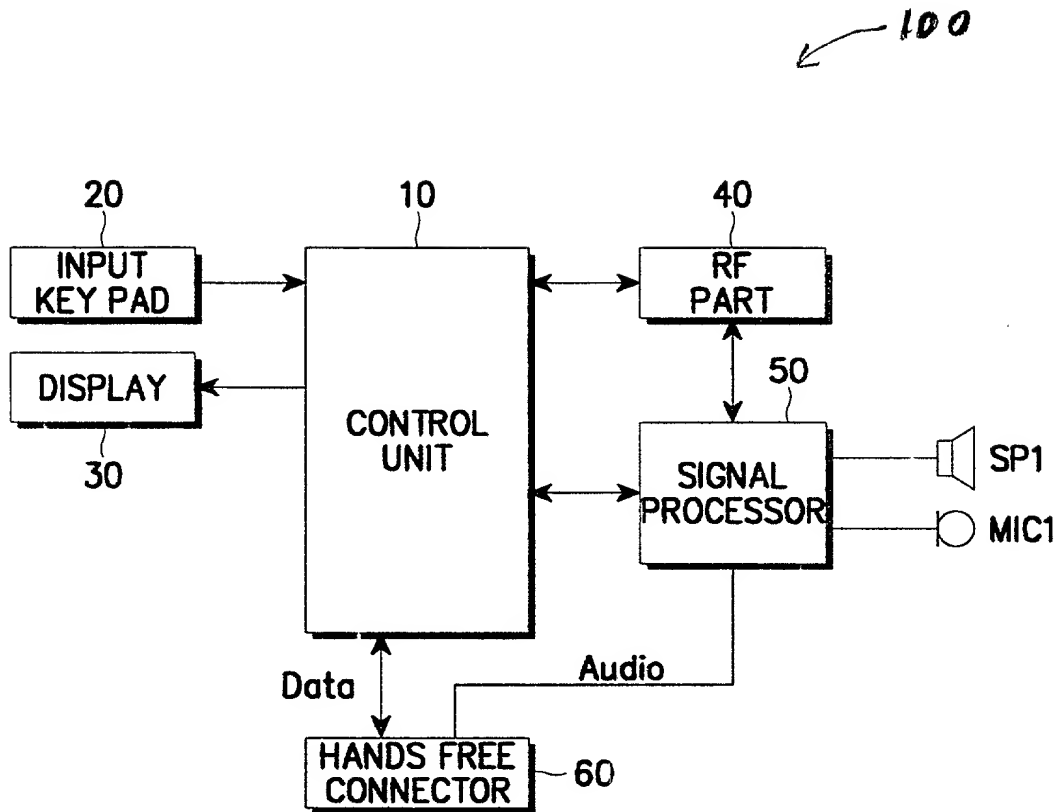


FIG. 2

3/4

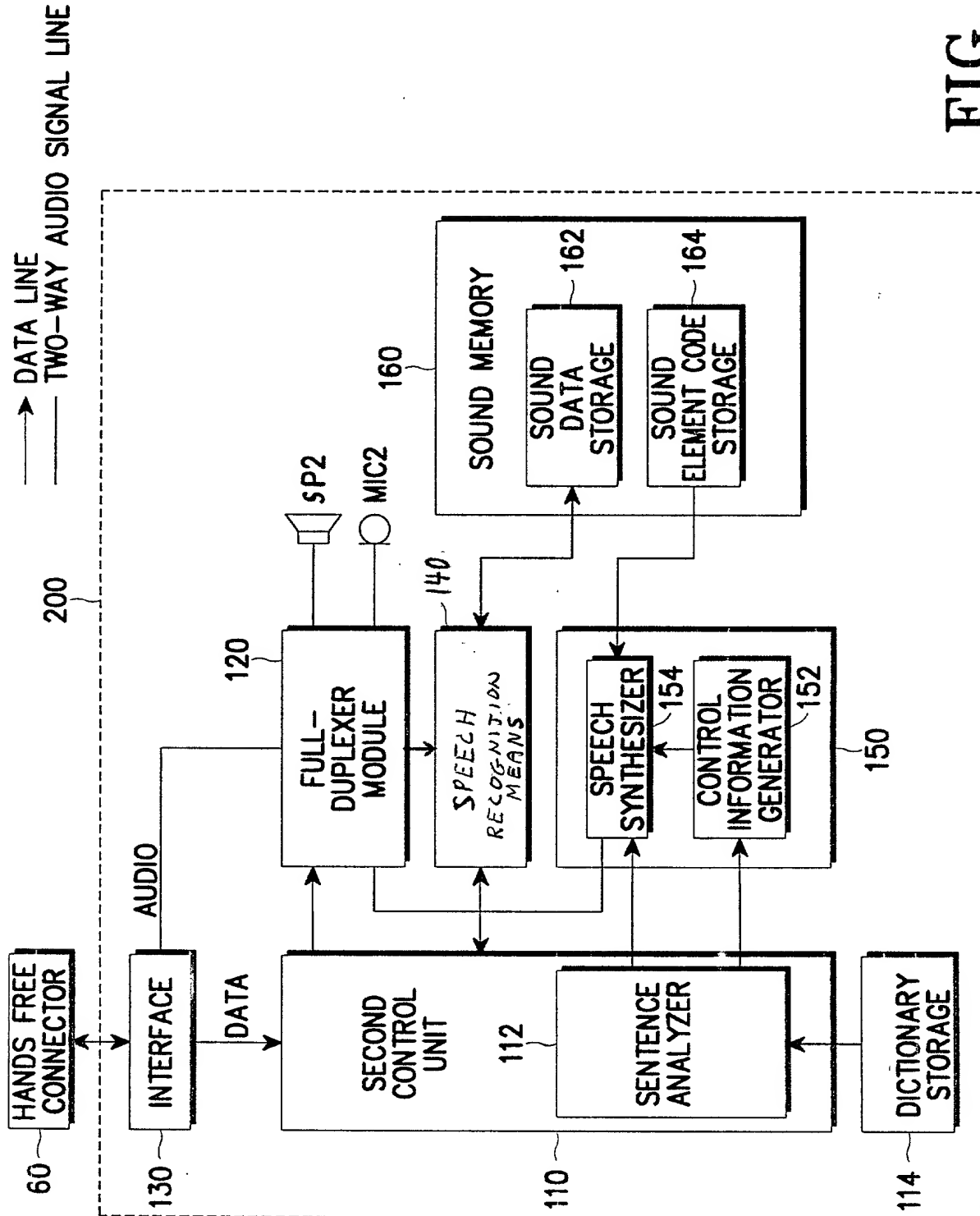


FIG. 3

4/4

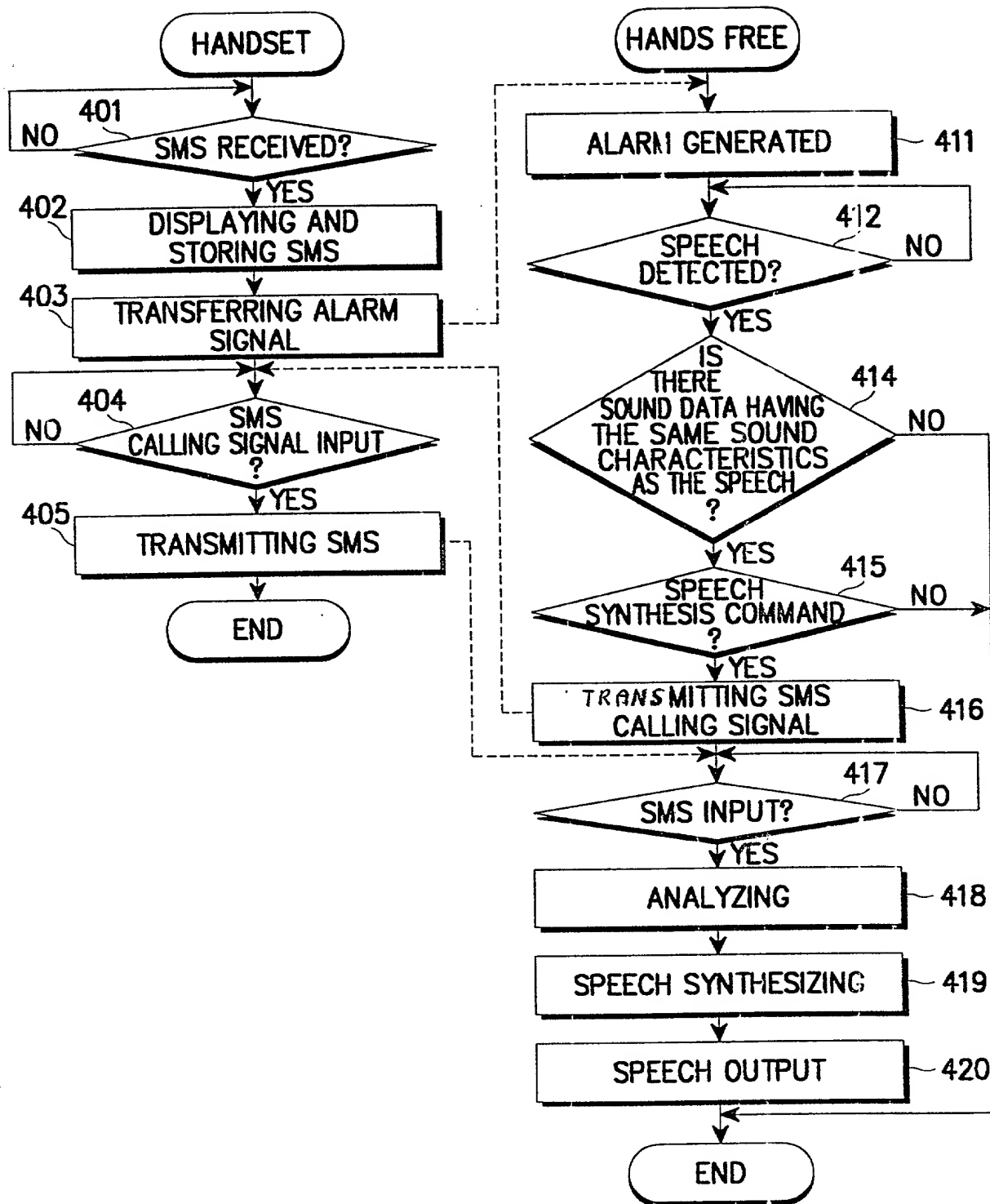


FIG. 4

DECLARATION

Attorney Docket No. 678-231
(P8635)

AS A BELOW NAMED INVENTOR, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe that I am the original, first and sole (*if only one name is listed below*), or an original, first and joint inventor (*if plural names are listed below*), of the subject matter which is claimed and for which a patent is sought on the invention entitled:TITLE: APPARATUS FOR SYNTHESIZING SPEECH SOUNDS OF A SHORT MESSAGE IN A
HANDS FREE KIT FOR A MOBILE PHONEthe specification of which either is attached hereto or indicates an attorney docket no. 678-231, or:

(P8635)

☐ was filed in the U.S. Patent & Trademark Office on _____ and assigned Serial No. _____☐ and (*if applicable*) was amended on _____

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability and to the examination of this application in accordance with Title 37 of the Code of Federal Regulations §1.56. I hereby claim foreign priority benefits under Title 35, U.S. Code §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, or §119(e) of any United States provisional application(s), listed below and have also identified below any foreign applications for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Priority Claimed:

<u>1998-7287</u>	<u>Korea</u>	<u>05/03/98</u>	Yes [X] No []
(Application Number)	(Country)	(Day/Month/Year filed)	

_____	_____	_____	Yes [] No []
(Application Number)	(Country)	(Day/Month/Year filed)	

I hereby claim the benefit under Title 35, U.S. Code, §120, of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application(s) in the manner provided by the first paragraph of Title 35, U.S. Code, §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, The Code of Federal Regulations, §1.56(a) which became available between the filing date of the prior application and the national or PCT international filing date of this application:

_____	_____	_____
(Application Serial Number)	(Filing Date)	(STATUS: patented, pending, abandoned)

_____	_____	_____
(Application Serial Number)	(Filing Date)	(STATUS: patented, pending, abandoned)

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FULL NAME OF FIRST OR SOLE INVENTOR: Byung-Seok RYU Citizenship Korea

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